CLAIMS:

1. A method of fabricating a thin film transistor active matrix backplane, comprising the steps of:

depositing a first passivation layer on a polyimide substrate to passivate the substrate;

applying a gate material to the first passivation layer;

patterning the gate material to form an array of gate electrodes;

depositing a gate insulating layer over the gate electrodes and the first passivation layer;

depositing a channel layer comprising amorphous silicon over the gate insulating layer;

depositing a contact layer comprising phosphorus doped amorphous silicon on the semiconducting channel layer;

depositing a source-drain layer on the contact layer;

patterning an array of source electrodes, drain electrodes, lines and pads in the source-drain layer;

patterning an array of transistor islands on the source and drain electrodes;

depositing a protective layer on the source-drain layer; and

exposing the drain electrodes and pads.

2. The method of claim 1, further comprising the step of annealing the backplane at elevated temperatures in a forming gas.

3. The method of claim 1, wherein the polyimide substrate is a flexible film.

4. The method of claim 1, further comprising the step of cleaning the polyimide substrate prior to the step of depositing the first passivation layer.

5. The method of claim 4, wherein the step of cleaning the polyimide substrate comprises the steps of:

washing the polyimide substrate; and
exposing the polyimide substrate to a plasma.

6. The method of claim 1, wherein the passivation layer comprises SiN_x.

7. The method of claim 6, wherein the step of depositing the passivation layer comprises using a gas mixture of H_2, SiH_4 and NH_3 at about 150 °C at about 0.5 Torr and about 0.067 Watts per centimeter squared.

8. The method of claim 7, wherein the passivation layer has a thickness of between about 250 nanometers and about 1000 nanometers.

9. The method of claim 1, further comprising the step of depositing a second passivation layer on a bottom surface of the polyimide substrate.

10. The method of claim 1, wherein the gate material comprises a first layer of a first metal and a second layer of a second metal overlying the first layer.

11. The method of claim 10, wherein the first metal in the gate material is aluminum and the second metal is chromium.

12. The method of claim 10, wherein the first metal in the gate material is titanium and the second metal is chromium.

13. The method of claim 10, wherein the first layer of the gate materiel is between about 500 angstroms and about 2000 angstroms thick and the second layer of the gate material is between about 50 angstroms and about 200 angstroms thick.

14. The method of claim 1, wherein the step of patterning the gate material to form an array of gate electrodes comprises providing a first mask and aligning the mask with the polyimide substrate and an array of gate electrode features and gate line features.

15. The method of claim 14, wherein the step of patterning the gate material further comprises the photolithographic steps of:

spin coating the sample with an adhesive promoter;

applying photoresist layer;

heating the sample;

etching the gate material; and

removing the photoresist.

16. The method of claim 1, wherein the step of depositing the gate insulating layer comprises using plasma enhanced chemical vapor deposition techniques.

17. The method of claim 16, wherein the gate insulating layer comprises SiN_x.

18. The method of claim 16, wherein the step of depositing the gate insulating layer uses a gas mixture of H_2, SiH_4 and NH_3 at about 150 °C at about 0.5 Torr and about 0.067 Watts per centimeter squared.

19. The method of claim 18, wherein the gate insulating layer has a thickness of between about 1800 angstroms and about 7200 angstroms.

20. The method of claim 1, wherein the step of depositing the amorphous silicon semiconducting channel layer uses a mixture of SiH_4 and H_2 at about 150 °C at about 0.5 Torr and about 0.027 Watts per centimeter squared.

21. The method of claim 20, wherein the channel layer has a thickness of between about 1000 angstroms and about 4000 angstroms.

22. The method of claim 1, wherein the step of depositing the contact layer uses a mixture of SiH_4 at about 44 sscm and PH3 at about 6 sscm at about 0.5 Torr and about 0.018 Watts per centimeter squared.

23. The method of claim 22, wherein the contact layer has a thickness of between about 250 angstroms and about 1000 angstroms.

24. The method of claim 1, wherein the source-drain layer comprises aluminum.

25. The method of claim 1, wherein the source drain layer comprises a first layer of a first metal, a second layer of a second metal overlying the first layer, and a third layer of a third metal overlying the second layer.

26. The method of claim 25, wherein the first metal in the source drain material is chromium, the second metal is aluminum and the third layer is chromium.

27. The method of claim 25, wherein the first layer of the source-drain material is about 100 angstroms thick and the second layer of the gate material is about 1000 angstroms thick and the third layer is about 100 angstroms thick.

28. The method of claim 1, wherein the step of depositing one of the source-drain and the gate metal layer comprises using one of an e-beam evaporator and a thermal evaporator.

29. The method of claim 1, wherein the step of patterning the array of source electrodes, drain electrodes, lines and pads in the source-drain layer comprises using a second mask having alignment marks and an array of source electrode features, drain electrode features, line features and pad features.

30. The method of claim 29, wherein the source-drain layer is patterned using a contact aligner.

31. The method of claim 29, wherein the step of patterning the source-drain material further comprises the photolithographic steps of:

spin coating the sample with an adhesive promoter;

applying a photoresist layer;

heating the sample;

etching the source and drain electrodes, lines and pads;

heating the sample;

dry etching the contact layer with a plasma etcher using CF_4,

removing the photoresist.

32. The method of claim 1, wherein the step of patterning the transistor islands comprises the steps of providing a third mask and using a photolithography technique to pattern the island.

33. The method of claim 32, wherein the step of patterning the channel material to form the transistor islands further comprises:

spin coating the sample with an adhesive promoter;

applying photoresist;

heating the sample;

etching the channel layer with a plasma etcher using CF_4; and

removing the photoresist.

34. The method of claim 1, wherein the step of depositing the protective layer comprises using a plasma enhanced chemical vapor deposition technique.

35. The method of claim 34, wherein the protective layer comprises SiN_x.

36. The method of claim 35, wherein the step of depositing the protective layer comprises using a gas mixture of H_2, SiH_4 and NH_3 at about 150 °C at 0.5 Torr and 0.067 Watts per centimeter squared.

37. The method of claim 36, wherein the protective layer has a thickness of about 2600 Angstroms.

38. The method of claim 36, wherein the step of patterning the protective layer further comprises:

spin coating the sample with an adhesive promoter;

applying photoresist layer;

heating the sample;

dry etching the protective with a plasma etcher using CF_4 and O_2; and

removing the photoresist.

39. The method of claim 1, wherein the step of exposing the drain electrodes and pads comprises employing a reactive ion etching technique to remove a portion of the gate insulating layer and the protective layer.

40. The method of claim 2, wherein the step of annealing has a duration of about one hour at a temperature of about 195°C and wherein the forming gas is 15 % H_2 in N_2.

41. A polymer dispersed electronic display comprising:

a backplane having an active matrix thin film transistor array formed on a flexible polyimide substrate;

a top layer of indium tin oxide coated polyester; and

a middle layer disposed between the backplane and the top layer composed of a 20:80 mixture of prepolymer PN393 and TL213;

wherein the middle layer is cured using a light source.

42. A method of making a polymer dispersed electronic display, comprising the steps of:

forming an active matrix thin film transistor array backplane on a polyimide substrate;

depositing a display medium on the active matrix thin film transistor array backplane;

depositing a protective layer comprising indium tin oxide coated polyester over the display medium; and

curing the display medium between the backplane and the protective layer.

43. A thin film transistor backplane, comprising:

a polyimide substrate;

a first passivation layer deposited on a deposition surface of the polyimide substrate;

an array of gate electrodes and gate lines patterned on the passivation layer;

a gate insulating layer deposited over the array of gate electrodes and gate lines;

a semiconducting channel layer deposited over the gate insulating layer;

a contact layer deposited on and in contact with the channel layer; and

an array of source electrodes, drain electrodes, lines and pads fabricated on and in contact with the contact layer.

44. A portable electronic device comprising,

a housing to house a portion of one or more components of said portable electronic device; and

a display assembly coupled to a flexible backplane assembly having formed thereon one or more transistors for displaying content to a user of the portable electronic device, the flexible backplane assembly capable of flexing in one or more dimensions to change a topography of a surface of the flexible backplane assembly, and wherein a portion of the display assembly forms a portion of the housing.

45. The portable electronic device of claim 44, wherein the display assembly comprises a flexible display assembly capable of displaying content to the user of the portable electronic device and capable of flexing to change a topography of a surface of the flexible display assembly, a portion of the flexible display forms a portion of the housing.

46. The portable electronic device of claim 44, wherein the flexible backplane assembly comprises a matrix of transistors formed on a flexible polyimide substrate.

47. The portable electronic device of claim 45, wherein the flexible display assembly comprises,

a flexible display medium, and

a flexible layer of transparent material disposed over a portion of the flexible display medium.

48. The portable electronic device of claim 44, wherein the housing comprises, a moveable member moveable from a first position to a second position to access a portion of the portable electronic device.

49. The portable electronic device of claim 47, wherein the flexible display medium comprises, a bi-stable, non-volatile display medium.

50. The portable electronic device of claim 49, wherein the flexible display medium comprises,

electrophoretic material having a pattern of addressable pixel locations; and

an activation grid for supplying a charge to selected addressable pixel locations to form the content for displaying to the user.

51. The portable electronic device of claim 49, wherein the flexible display medium comprises at least one of a plurality of bichromal spheres, a plurality of pneumatic liquid crystals, a plurality of cholesteric liquid crystals, and a plurality of chiral compounds.

52. The portable electronic device of claim 45, wherein the flexible display assembly is capable of having a first portion of the surface of the flexible display assembly flex to conform to a first radius and a second portion of the surface of the flexible display assembly flex to conform to a second radius.

53. The portable electronic device of claim 44, wherein the portable electronic device comprises at least one of, a personal digital assistant (PDA), a cell phone, a timepiece, and a mobile electronic device associated with a network.

54. The portable electronic device of claim 47, wherein the flexible display medium comprises a volatile medium.

55. The portable electronic device of claim 54, wherein the volatile medium comprises at least one of, an organic light emitting diode, a liquid crystal, and a polymer dispersed liquid crystal.

56. The portable electronic device of claim 47, wherein the flexible display medium comprises a medium that includes at least one of a surface stabilized ferroelectric liquid crystal, a fast multi stable liquid crystal, and OYNX™ chemical substance.

57. A flexible electronic display having a plurality of pixels, the flexible electronic display comprising,

a flexible display medium with a transparent reference electrode layer for displaying indicia to an operator, the indicia providing the operator with indications of a state of a monitored process; and

one or more thin film transistors coupled to the flexible display medium and formed on a substrate capable of flexing in a plurality of dimensions, the one or more thin film transistors and the flexible display medium flex to adapt to one or more contours of a surface of the instrument panel during mounting of said flexible electronic display thereto.

58. The flexible electronic display of claim 57, further comprising a device coupled to said one or more thin film transistors, the device providing said one or more thin film transistors with an input for rendering on said flexible display medium, the input including at least a response from a stimulus.

59. The flexible electronic display of claim 58, further comprising one or more decoder circuits coupled between said one or more thin film transistors and said device,

the one or more decoder circuits selecting a transistor from said one or more thin film transistors to address a selected pixel of said plurality of pixels of said flexible electronic display in response to said input from said device.

60. The flexible electronic display of claim 57, wherein the instrument panel is mounted in a mechanized vehicle.

61. The flexible electronic display of claim 60, wherein the mechanized vehicle includes at least one of an automobile, a locomotive, an airplane, a motorcycle, a watercraft, and a truck.

62. The flexible electronic display of claim 57, wherein the instrument panel is incorporated into a device for determining a present value of a quantity under observation.

63. The flexible electronic display of claim 57, wherein the plurality of pixel elements are capable of maintaining state in an absence of a selected input to said flexible display medium.

64. The flexible electronic display of claim 63, wherein the plurality of pixel elements are formed of compound that includes at least one of, an electronic ink, an electrophoretic material, a plurality of bichromal spheres, a plurality of nematic liquid crystals, a plurality of cholesteric liquid crystals, and a plurality of chiral compounds.

65. The flexible electronic display of claim 64, wherein the electronic ink comprises a compound formed from a plurality of particles, each of the plurality of particles is capable of entering one of two states to form a bi-stable imaging medium, wherein a first of the two states orients a selected one of the plurality of particles to reflect light and a second of the two states orients the selected one of the plurality of particles to absorb light.

66. The flexible electronic display of claim 64, wherein the electronic ink comprises at least one of, a plurality of bichromal spheres, a plurality of nematic liquid crystals, a plurality of cholesteric liquid crystals, and a plurality of chiral compounds.

67. The flexible electronic display of claim 64, wherein the electrophoretic material comprises at least one of, a plurality of bichromal spheres, a plurality of nematic liquid crystals, a plurality of cholesteric liquid crystals, and a plurality of chiral compounds.

68. The flexible electronic display of claim 64, wherein the electronic ink comprises conductive ink having an arrangement of particles, each of the particles has disposed therein an electrophoretic composition of a fluid and a suspension of colloidal material, the conductive ink being printable on an a medium by an image reproducing system.

69. The flexible electronic display of claim 57, wherein the plurality of pixel elements cause the flexible display medium to change state when a selected input to said flexible display medium is interrupted.

70. The flexible electronic display of claim 57, wherein the plurality of pixel elements cause the flexible display medium to become randomly dispersed when a selected input to said flexible display medium is interrupted.

71. The flexible electronic display of claim 57, wherein the plurality of pixel elements cause the flexible display medium to go off when a selected input to said flexible display medium is interrupted.

72. The flexible electronic display of claim 67, wherein the plurality of pixel elements are formed of a compound that includes at least one of, an organic light emitting diode, a liquid crystal, and a polymer dispersed liquid crystal.

73. The flexible electronic display of claim 57, wherein the flexible display medium comprises a plurality of pixel elements formed of a compound that includes at least one

of, a surface stabilized ferroelectric liquid crystal, a fast multi stable liquid crystal, and an OYNX™ chemical compound.

74. A display device for displaying content to a user, said display device comprising,

a matrix of transistors formed on a flexible substrate, the flexible substrate capable of flexing in one or more dimensions with the transistors formed thereon to adapt to a desired contour, and

a plurality of pixels coupled to the matrix of transistors, each of the plurality of pixels addressable by the matrix of transistors to transfer a change from a selected one of the matrix of transistors to one of the plurality of pixels to display a portion of the content to the user.

75. The display device of claim 74, wherein the flexible substrate comprises a polyimide material.

76. The display device of claim 74, wherein the matrix of transistors comprises a plurality of thin film transistors having at least one layer of amorphous silicon.

77. The display device of claim 74, wherein each of the plurality of pixels is coupled to at least one capacitor, the capacitor holding the charge transferred to the selected pixel from the matrix of transistors.

78. The display device of claim 74, wherein the plurality of pixels are formed of a compound that includes at least one of an electronic ink with a plurality of bichromal spheres, a electrophoretic material with a plurality of microencapsulated bichromal spheres, a electrophoretic material with particles micro encapsulated in a suspension fluid of a contrasting color, a plurality of nematic liquid crystals, a plurality of cholesteric liquid crystals, and a plurality of chiral compounds.

79. The display device of claim 78, wherein each of the materials comprises a compound formed from a plurality of particles, each of the plurality of particles is capable of entering one of two states to form a bi-stable imaging medium, wherein a first of the two states orients a selected one of the plurality of particles to reflect light and a second of the two states orients the selected one of the plurality of particles to absorb light, to reflect light, or to absorb light of different frequencies thereby creating contrasting colors.

80. The display device of claim 78, wherein the electronic ink comprises conductive ink having an arrangement of particles, each of the particles has disposed therein an electrophoretic composition of a fluid and a suspension of colloidal material, the conductive ink being printable on an a medium by an image reproducing system.

81. The display device of claim 74, wherein the plurality of pixels change state when a selected input to said display device is interrupted.

82. The display device of claim 74, wherein the plurality of pixels are formed of material that includes at least one of an organic light emitting diode, a liquid crystal, and a polymer dispersed liquid crystal.

83. The display device of claim 74, wherein the plurality of pixels comprises a compound formed with at least one of, a surface stabilized ferroelectric liquid crystal, a fast multi stable liquid crystal, and an OYNX™ chemical compound.

84. The display device of claim 74, further comprising a transparent layer of conductive material disposed over a surface of each of the plurality of pixels to form an electrode for selecting one of the plurality of pixels.

85. The display device of claim 84, wherein a pointing device passes over a portion of the electrode to select at least one of the plurality of pixels corresponding to the selected portion of the electrode.

86. The display device of claim 74, wherein the display device displays content from a stored location, the stored location present in a portion of the display device.

87. The display device of claim 74, further comprising a processor coupled to the matrix of transistors, the processor producing and driving the matrix of transistors with a portion of the content said display device displays.

88. The display device of claim 74, wherein a portion of the content said display device displays is provided by an electronic device associated with a network.

89. The display device of claim 72, further comprising a transponder layer coupled to the matrix of transistors for performing radio frequency identification (RFID).

90. The display device of claim 72, wherein the matrix of transistors and the plurality of pixels form a portion of an electronic label employing electronic ink.

91. The display device of claim 77, wherein the transistor that passes the charge to cause the selected pixel to change state is constructed on a polyimide material in a plurality of geometric patterns.

92. The display device of claim 91, wherein the plurality of geometric patterns comprises a plurality of two dimensional shapes.

93. The portable electronic device of claim 45, wherein a portion of the display assembly is formed in accordance with the method of claim 1.

94. The flexible electronic display of claim 58, wherein the one or more thin film transistors is formed in accordance with the method of claim 1.

95. The display device of claim 74, wherein a portion of the plurality of pixels and the matrix of transistors are formed in accordance with the method of claim 1.